IX. AUCTIONS FOR FREQUENCIES FOR SATELLITE SYSTEMS ARE NOT PRACTICAL

NASA can not endorse the Commission's proposed use of auctions to award licenses to FSS systems, even in the event that mutual exclusivity should occur between applicants' proposals.

The proposed NGSO/FSS system of Teledesic and the proposed GSO/FSS system of Hughes Spaceway are global in nature. They both intend to provide domestic service to multiple countries in addition to the United States. They also intend to provide inter-regional service and global international services.

The key feature of these FSS systems that distinguish them from terrestrial services and from U. S. domestic satellites at C - and K_u - bands is the provision of services outside the domestic confines of the United States. Should the Commission decide to award these satellite licensees by auction, it would follow that virtually every other country in the world could be expected to follow suit. Satellite operators would be faced with the impossible situation of having to compete in multiple auctions, country by country, in order to provide their services and to achieve economic viability. They would be subject to insincere bids from those who could see an opportunity to make a fast buck by buying licenses for resale at a large profit.

We can think of nothing that has the international ramifications to the satellite industry that auctioning of licenses would have. We foresee it leading to the eventual downfall of a thriving industry where the United States currently has a commanding lead. We urge the Commission to reject use of auctions for satellite licenses.

X. THE PROPOSED BAND SEGMENTATION PLAN IS DEFICIENT AND SHOULD BE MODIFIED

The amount of spectrum proposed in the Commission's band segmentation plan for the FSS is inadequate to accommodate requirements already contained in applications before the Commission, let alone accommodate requirements forecast to arise in the near future. Limiting the primary spectrum available for satellite services in the 27.5-30 GHz band will impede the growth of the U. S. satellite industry, reduce competition among satellite providers and preclude future service opportunities, some of which are yet to be identified. As satellite applications are becoming increasingly global in nature, deviation from internationally recognized allocations by the U. S. will also have adverse economic and competitive implications on the satellite industry.

We urge the Commission to revise its proposed plan to provide additional spectrum for the FSS within 27.5 to 30 GHz. We believe that this objective can be readily achieved by shifting the bulk of the spectrum to be allocated for LMDS to the 40.5-42.5 GHz band. We have shown, in this and in previous filings, that LMDS is viable at 41 GHz. Mass production of LMDS components has been shown to have a similar lead time at either 28 GHz or at 41 GHz. The lead time required to achieve quantity production at 28 GHz is tacitly recognized by the lenient build-out requirements proposed in the NPRM. Equipment can be available at 41 GHz to satisfy these build-out requirements.

Our proposal is to delete LMDS in the 27.5-28.35 GHz band and to designate it instead for the FSS. We recommend that LMDS be retained in the 29.1-29.25 GHz band where sharing between the LMDS and MSS feeder links has been shown to be feasible. This 150 MHz wide band would enable LMDS to implement systems now that will be competitive with today's cable systems if industry were to adopt use of digital modulation for LMDS. Sixty video channels are feasible in 150 MHz, 10 more than planned by CellularVision in 1000 MHz using FM technology. Pugh and Boyer[31] report that many cable TV systems are in service today that provide 40 channels. They also report that it will take at least a decade to provide broadband network access to a majority of U. S. households due to the lead time to manufacture network components, obtain capital and construct the network facilities.

Allocation of the 40.5-42.5 GHz band for LMDS will insure that adequate spectrum will be available for this new service to compete with other providers of broadband video services such as wired cable, direct broadcast satellites and MMDS. To be competitive with cable operators, DBS operators, and others who will field expanded capability systems for multichannel video programming over the coming decade will require that LMDS, in the long term, have a capacity on the order of 200 video channels. The bandwidth available in the 40.5-42.5 GHz band, coupled with the use of digital technology, is ideal for this purpose. It also offers ample opportunity for implementation of LMDS systems for educational uses. An additional benefit would be realized because multiple licenses could be awarded in the same BTA, thus insuring competition with both LECs and wired cable companies.

We urge the Commission to modify its band segmentation plan as we propose.

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31 William Pugh and Gerald Boyer, "Broadband Access: Comparing Alternatives", IEEE Communications Magazine, August, 1995, Vol. 33 No. 8.

XI. CO-FREQUENCY USE OF UPLINKS AND DOWNLINKS FOR NGSO/MSS FEEDER LINKS AND GSO/FSS IS FEASIBLE WITH ADOPTION OF APPROPRIATE PROCEDURES

Informal Working Group 4 (IWG-4) of the FCC Industry Advisory Committee for the 1995 World Radiocommunication Conference (WRC-95) has analyzed the potential for co-directional frequency sharing (i.e. same uplink and downlink frequencies) in the 30/20 GHz bands between NGSO MSS feeder links and various FSS satellite systems. Because non-geostationary satellites are in continuous motion with respect to geostationary satellites, this time-varying geometry gives rise to a number of short duration "in-line" interference events which occur whenever a non-GSO satellite passes through the main beam of a given GSO satellite (i.e. the NGSO satellite appears along the line-of-sight between the MSS feeder link station and the GSO satellite). During these "in-line" events - whose duration and frequency of occurrence depends on the satellite orbital parameters, ground station locations, number of satellites, etc. - four possible interference paths can occur as follows:

(1) MSS feeder link earth station uplink interference into GSO FSS satellite;

(2) FSS earth station uplink interference into NGSO MSS satellite;

(3) NGSO MSS satellite downlink interference into FSS earth station; and

(4) GSO FSS satellite downlink interference into MSS feeder link earth station.

Various IWG-4 studies were conducted to determine the severity of these interference events and to examine various interference mitigation techniques. One report by NASA LeRC[32] examines co-frequency sharing between NGSO/MSS feeder links modeled after the proposed medium earth orbit (10355 km) Odyssey

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32 See document IWG4/51, "Co-directional Frequency Sharing Between NGSO MEO MSS Feeder links and GSO Satellite System Operating in the 30/20 GHz Band."

system and a GSO FSS system modeled after the Hughes' Spaceway system. Another report by CSC[33] examines co-frequency sharing between NGSO/MSS feeder links modeled after the low earth orbit (800 km) Iridium system and a GSO FSS system modeled after Spaceway. In general, it was found that the use of exclusion zones, orbit avoidance, and path diversity are particularly effective mitigation methods to eliminate the identified interference problems. Certain of these remedies are inherently available in the systems concerned while others can be easily implemented. In any case, Coordination is required between the affected parties in order to determine the extent to which these techniques can be implemented. In light of the IWG-4 findings, and in consideration of the worst-case nature of many of the underlying assumptions used in the studies, it is concluded that codirectional sharing between GSO FSS networks and NGSO MSS feeder links in the 30/20 GHz bands is feasible on both uplinks and downlinks if appropriate procedures are put in place to mitigate the interference that would otherwise occur.

The Conference Preparatory Meeting (CPM) for WRC-95 came to similar conclusions[34] that frequency sharing may be possible at 20 and 30 GHz in some cases by use of interference reduction mechanisms.

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33 Document IWG4/54, "Co-Frequency Sharing at Ka-Band Between GSO FSS and Non-GSO MSS Feeder link Systems."

34 See the CPM Report to WRC-95 at Chapter 2, Section 1, Part C, 3.1.8.

XII. USE OF 18.6-18.8 GHz FOR NGSO/FSS OR MSS FEEDER LINKS IS NOT FEASIBLE

We want to reiterate that there is a primary allocation in ITU Region 2 for the Earth exploration-satellite (passive) and the space research (passive) services in the 18.6-18.8 GHz band. Footnote U. S. 255 in the U. S. radio regulations limits the power flux density produced at the earth's surface to - 101 dBW/200 MHz in this band in order to prevent unacceptable interference to passive sensors. NGSO/FSS and MSS feeder links are not expected to be compatible with passive sensors. The Commission's plans for the 17.7 - 20.2 GHz FSS down link band properly avoid placement of the NGSO/FSS and MSS feeder links in this important band for environmental remote sensing.

XIII. SUMMARY AND CONCLUSIONS

The NASA is gravely concerned that the band segmentation plan proposed in this NPRM will deprive the U. S. satellite industry of the spectrum needed to introduce the innovative new services that can be provided only at K_a-band frequencies with the result that the growth potential of the U. S. satellite industry will disappear. The plan in its present form will not even accommodate today's requirements for systems in applications before the Commission.

We concur with the Commission's tentative conclusion that co-frequency sharing between LMDS systems and either GSO/FSS or NGSO/FSS systems is not feasible at this time.

We believe that the Commission has erred in its conclusion that LMDS is not viable at 41 GHz. We are disappointed that the Commission has chosen to ignore the in-depth analysis that we provided to the Commission which shows that

LMDS is, indeed, viable at 41 GHz. Comments in response to the Commission's NPRM on use of frequencies above 40 GHz further support the viability of LMDS services at 41 GHz. The Commission, in ET Docket No. 94-124 has actually stated its view that many of the uses of millimeter spectrum are likely to be technically and operationally similar to those contemplated for LMDS at 28 GHz and proposes to model its rules for 40.5-42.5 GHz after the rules and procedures proposed for LMDS. This important information bearing favorably on use of 41 GHz for LMDS has not been adequately considered in devising the band segmentation plan for 27.5 - 30 GHz.

Digital technology for implementation of LMDS is available today for use by industry in LMDS systems. Any other form of modulation would cause a gross waste of valuable spectrum and would be inconsistent with the Commission's desire to insure efficient use of this scarce resource.

NASA can not endorse the Commission's proposed use of auctions to award licenses to FSS systems because of the implications that auctions would disrupt implementation of global satellite networks.

We urge the Commission to modify its band segmentation plan by deleting LMDS in the 27.5-28.35 GHz band and by designating this spectrum instead for the FSS. We recommend that LMDS be retained in the 29.1-29.25 GHz band where sharing between the LMDS and MSS feeder links has been shown to be feasible. This 150 MHz wide band would enable LMDS to immediately implement systems competitive with today's cable systems if industry were to adopt digital modulation for LMDS.

We propose that the principal accommodation of LMDS be in the 40.5 - 42.5 GHz band where adequate spectrum is available for this new service to compete with cable operators, DBS operators, and others who will field expanded capability systems for multichannel video programming over the coming decade. The bandwidth available in the 40.5-42.5 GHz band, coupled with the use of digital technology, is ideal for this purpose.

The opportunity is at hand to provide American industry and the American public with the full range of benefits that both LMDS and satellite systems can provide. But, adequate spectrum must be made available for both services if this desirable result is to be realized. Happily, there is a solution that can make it happen. We urge the Commission to modify its band segmentation plan as we have proposed.

Respectively submitted,

By:
Charles T. Force
Associate Administrator for
Space Communications
National Aeronautics and Space
Administration

August 28, 1995

APPENDIX 1

COMMENTS OF THE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FILED UNDER ET DOCKET NO. 94-124

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of

Amendment of Parts 2 and 15 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications	))))	**ET Docket No. 94-124** **RM-8308**

COMMENTS OF THE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Charles T. Force
Associate Administrator
Office of Space Communications
National Aeronautics and Space Administration

January 30, 1995

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SUMMARY

NASA believes that it is timely to consider how frequencies above 40 GHz can best be used for the benefit of the American public and industry. NASA agrees with the Commission in its view that the proposals set forth in its NPRM will provide the American public with access to new products and communications services, provide new opportunities for American business and industry, and promote new jobs and economic growth in the United States.

NASA is in the forefront of development and use of millimeter wave devices for applications in space and we take a great deal of interest in the proposals contained in the instant Notice. We carry out environmental spaceborne remote sensing measurements using both active and passive sensors in the frequency regime above 40 GHz. We sponsor an active program to quantify the effects of propagation through the Earth's atmosphere on the properties of radio wave transmission and can therefore offer authoritative information to the Commission on the important mechanisms that need to be taken into account in the frequency range above 40 GHz.

NASA continues to develop high-risk, innovative technology for the benefit of U.S. industry and the American public. The latest communications satellite to be developed by NASA is the Advanced Communications Technology Satellite ("ACTS"), launched in September, 1993. ACTS has been designed to pioneer the 20/30 GHz K_a-bands for subsequent use by the American satellite communications industry. Thus, ACTS directly

benefits the constituency of the FCC: American industry and the American public.

NASA believes that the proposals in the subject NPRM can provide the basis for solving the incompatibilities that would exist in the 27.5-29.5 GHz band were that band to be allocated to both the Fixed-Satellite Service (FSS) and to a new Local Multipoint Distribution Service ("LMDS") as contemplated in CC Docket No. 92-297. The effect of the Commission's proposals in the instant NPRM would be to create a band at 40.5-42.5 GHz with virtually the same conditions as that proposed at 27.5-29.5 GHz. The same 2 GHz of bandwidth would be established, to be licensed in the same 1000 MHz blocks. The propagation environment at 40 GHz is similar to that in the nearby 28 GHz band as are the equipment parameters. Only the name has changed from LMDS to LMWS.

NASA believes that the Commission's proposal for commercial use of the 40.5-42.5 GHz band is the key to resolving the severe incompatibility problems that exist between the FSS and the LMDS in the 27.5-29.5 GHz band. Use of the 40.5-42.5 GHz band for LMDS in lieu of the 27.5-29.5 GHz band would result in a win-win situation for the American public and for American industry. The satellite industry would be free at 27.5-29.5 GHz to build on the technologies pioneered by NASA's ACTS to fill an essential role in the National/Global Information Infrastructure (NII/GII). At the same time, LMDS could be developed without interference from the FSS in the 40.5-42.5 GHz band. American industry would have the opportunity to participate in two global markets rather than none since the FSS is allocated in the 27.5-29.5 GHz band on a global basis and the functionally equivalent European version of LMDS is being developed in the 40.5-42.5 GHz band.

The frequency range from 50 to 65 GHz is of particular interest to the Earth environmental science and meteorological communities because of the presence of unique atmospheric oxygen absorption lines that are located in this region of the spectrum. Spaceborne passive sensor measurements in the vicinity of these lines are used to develop atmospheric temperature profiles. Judicious selection of the measurement frequencies determines the altitudes in the atmosphere at which temperature measurements are obtained.

The Commission requests comment on whether terrestrial use of the 60.4-61.4 GHz band would interfere with planned spaceborne passive sensor measurements of atmospheric temperature. NASA has analyzed the sharing potential and concludes that, in this frequency range where measurements provide data on temperatures in the mesosphere, sharing is feasible.

The proposed use of 116-117 GHz and 122-123 GHz bands for unlicensed devices gives NASA a great deal of concern because both of these bands fall within the 116-126 GHz band allocated for the Earth exploration-satellite (passive) and space research (passive) services. We recommend that either alternative bands, outside bands allocated for passive sensing, be chosen in place of the 116-117 GHz and 122-123 GHz bands or that the transmitter power in these two bands be limited to -16 dBW in order to achieve compatibility.

The NASA propagation research program publishes a handbook on propagation effects for satellite systems design in the frequency range between 10 and 100 GHz. While this handbook is directed particularly to satellite system designers, most of the information applies equally to terrestrial communications links. We believe that the contents of this document can be valuable to the Commission as it plans how to allocate, license and use frequencies above 40 GHz. For that reason, we are appending the NASA handbook to these comments.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of

Amendment of Parts 2 and 15 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications	))))	ET Docket No. 94-124 RM-8308

COMMENTS OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

The National Aeronautics and Space Administration ("NASA") hereby submits its comments in response to the Notice of Proposed Rulemaking (NPRM) issued in the above-captioned proceeding.

I. INTRODUCTION

NASA agrees with the Commission in its view that the proposals set forth in its NPRM will provide the American public with access to new products and communications services, provide new opportunities for American business and industry, and promote new jobs and economic growth in the United States.

NASA is in the forefront of development and use of millimeter wave devices for applications in space and we take a great deal of interest in the proposals contained in the instant Notice. We carry out environmental spaceborne remote sensing measurements using both active and passive sensors in the frequency regime above 40 GHz. We sponsor an active program to quantify the effects of propagation through the Earth's atmosphere on the properties of radio wave transmission and can therefore offer authoritative information to the Commission on the important mechanisms that need to be taken into account in the frequency range above 40 GHz.

NASA continues to develop high-risk, innovative technology for the benefit of U.S. industry and the American public. The latest communications satellite to be developed by NASA is the Advanced Communications Technology Satellite ("ACTS"), launched in September, 1993. It operates in the 20/30 GHz bands ("Ka-band") allocated world-wide to the Fixed-Satellite Service ("FSS") and designated in the United States for non-government use[1]. ACTS has been designed to pioneer these bands for subsequent use by the American communications industry. Thus, ACTS directly benefits the constituency of the FCC: American industry and the American public.

The payoff for this important investment by NASA on behalf of the American taxpayer, in the form of new Ka-band satellite communications services and ensuring that the U.S. remains the world leader in satellite communications, requires continued access to K_a band frequencies for the American satellite industry.

NASA believes that the proposals in the subject NPRM can provide the basis for solving the incompatibilities that would exist in the 27.5-29.5 GHz band were that band to be allocated to both the Fixed-Satellite Service (FSS) and to a new Local

1 Specifically, ACTS uplinks operate on 29.242 GHz (+/- 20.5 MHz), 29.263 GHz (+/ 82.5 MHz), and 29.298 GHz (+/ 20.5 MHz).

Multipoint Distribution Service ("LMDS") as contemplated in CC Docket No. 92-297[2].

Certain of the frequency bands above 40 GHz that the Commission proposes to reallocate are allocated and used for spaceborne passive remote sensing. A wealth of knowledge about the technical and operational aspects of remote sensing has developed since these frequency bands were first allocated at the 1979 World Administrative Radio Conference (WARC). We have analyzed the potential for sharing between passive spaceborne sensors and the terrestrial devices proposed in this NPRM. We conclude, in response to the Commission's request for comment concerning the 60.4-61.4 GHz band, that sharing is feasible in this band. However, the proposed use of 116-117 GHz and 122-123 GHz bands for unlicensed devices gives NASA a great deal of concern. We believe that either alternative bands should be chosen for unlicensed devices or that limits should be placed on the transmitter power of unlicensed devices in these two bands in order to achieve compatibility.

II. THE 40.5-42.5 GHz BAND SHOULD BE DESIGNATED FOR LMDS IN LIEU OF THE 27.5-29.5 GHz BAND

The Commission has stated that it believes that many of the uses of spectrum above 40 GHz will be technically and operationally similar to those fixed point-to-point services for video, voice and data transmission to subscribers throughout an area that have been proposed for LMDS in the 28 GHz band[3]. It therefore

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2 *See* Rulemaking to Amend Part 1 and Part 21 of the Commission's Rules to Redesignate the 27.5 - 29.5 GHz Frequency Band and to Establish Rules and Policies for Local Multipoint Distribution Service, CC Docket No. 92-297, Notice of Proposed Rulemaking, Order, Tentative Decision and Order on Reconsideration, 8 FCC 557 (1993).

3 NPRM at para. 23.

proposes licensing rules similar to those proposed for LMDS. The net effect of these proposals would be to create a band at 40.5-42.5 GHz with virtually the same conditions as that proposed at 27.5-29.5 GHz. The same 2 GHz of bandwidth would be established, to be licensed in the same 1000 MHz blocks. The propagation environment at 40 GHz is similar to that in the nearby 28 GHz band as are the equipment parameters. Only the name has changed from LMDS to LMWS.

The Commission currently has a Rulemaking proceeding underway to consider the redesignation of the 27.5-29.5 GHz band for a new LMDS on a co-primary basis with the FSS[4]. A group of experts recently met under the auspices of an FCC Negotiated Rulemaking Committee (NRMC) to examine the feasibility of co-frequency sharing between the proposed LMDS and the FSS[5]. The committee was to formulate rules, if possible, to maximize the co-frequency sharing. Despite the intense efforts of this group of experts, it was not possible to devise a method that would make co-frequency sharing feasible.

NASA believes that the Commission's proposal for commercial use of the 40.5-42.5 GHz band is the key to resolving the severe incompatibility problems that would be created were the 27.5-29.5 GHz band to be allocated on a co-primary basis to the FSS and the LMDS. Use of the 40.5-42.5 GHz band for LMDS in lieu of the 27.5-29.5 GHz band would result in a win-win situation for the American public and for American industry. The satellite industry would be free at 27.5-29.5 GHz to build on the technologies pioneered by NASA's ACTS to fill an essential role in

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4 Local Multipoint Distribution Service, 9 FCC Rcd 1394 (1994).

5 NASA was a member of the NRMC.

the National/Global Information Infrastructure (NII/GII). Indeed, Hughes, Teledesic and Iridium already have applications before the Commission to develop global satellite networks in this frequency band. At the same time, LMDS could be developed without interference from the FSS in the 40.5-42.5 GHz band. American industry would have the opportunity to participate in two global markets rather than none since the FSS is allocated in the 27.5-29.5 GHz band on a global basis and the functionally equivalent European version of LMDS[6] is being developed in the 40.5-42.5 GHz band.

Propagation considerations

One question that might reasonably be raised would be about the effect of propagation on LMDS if LMDS were to operate at 41 GHz rather than at 28 GHz. An examination of the design of a leading contender for LMDS[7] proves conclusively that there is virtually no difference in the operation of LMDS at the higher frequency.

The propagation effects that need to be examined as functions of frequency are attenuation due to atmospheric gasses and attenuation due to precipitation.[8] The attenuation due to water vapor and oxygen over the maximum distance of 4.8 km from hub to subscriber in the proposed system, while insignificant at both

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6 Designated as the Multipoint Video Distribution System (MVDS).

7 Suite 12 system characteristics as documented in "Report of the LMDS/FSS 28 GHz Band Negotiated Rulemaking Committee", Appendix 6, Section 2.1, September 23, 1994.

8 See CCIR Report 338-5, "Propagation Data and Prediction Methods Required for Line-of-Sight Radio-Relay Systems".

frequencies[9], is a mere 0.25 dB more at the higher frequency. This increased loss is more than offset by the 3 dB higher gain in the vertical plane that the same physical aperture antenna will provide at 41.5 GHz compared to 28.5 GHz.

The effect on availability of an LMDS hub to subscriber link in New York due to attenuation caused by precipitation has also been evaluated. The hub and subscriber are assumed to be seperated by the maximum distance of 4.8 km. The subject design has a 13 dB margin to compensate for rain attenuation. For a uniform rain rate over the path, the available margin of 13 dB will just compensate for a specific attenuation due to rain of 2.7 dB/km. CCIR Report 721-2 provides the information that this specific attenuation corresponds to a rain rate of 14.9 mm/hr at 28.5 GHz. New York lies in Crane rain climate region D2[10] where rainfall rates of 14.9 mm/hr are exceeded for no more than 0.1 % of an average year. At 41.5 GHz, taking into account the increase in hub antenna gain compared to that at 28.5 GHz, we find an available margin of 16 dB which will compensate for a specific attenuation due to rain of 3.33 dB/km. This rain rate corresponds to a rainfall rate of 10.5 mm/hr and is exceeded in New York for 0.16 % of the year.

The preceding analysis shows that there is an insignificant difference in the availability of the LMDS hub to subscriber link at 41.5 GHz compared to that at 28.5 GHz. The availability of the link is 99.9 % at 28.5 GHz and 99.84 % at 41.5

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9 The sum of attenuation due to oxygen and water vapor over a 4.8 km path for a water vapor density of 7.5 g/m^2 is 0.47 dB at 28.5 GHz and 0.72 dB at 41.5 GHz.

10 Crane, R.K., "Prediction of Attenuation by Rain", IEEE Trans. Comm., Vol. COM-28, No. 9, pp. 1717-1733, 1980.

GHz[11]. The availability is, of course, higher for the great majority of hub to subscriber links at shorter distances. Even this small effect could easily be compensated for, if desired, by the use of power control at the hub.

Reflectivity Properties

At least one LMDS proponent expects to partially rely on reflected signals to provide adequate signals between hub and subscriber terminals. Laboratory experiments have been conducted at NASA's Lewis Research Center to assess reflective properties of various materials commonly used in building construction as a function of frequency. Specifically, the tests were designed to examine the behavior of reflected signals in the 28 GHz to 40 GHz frequency range.

The laboratory test configuration is shown in Figure 1. Standard waveguide horns, specified for use in the frequency range 26.5-40 GHz were aligned at angles of 10, 30, 45 and 60 degrees from perpendicular to four different reflective surfaces; unpainted concrete block, a flat metal sheet, unpainted plywood, and a glass mirror. The transmit and receive waveguide horns were each positioned at a distance of 10 feet from the center of the reflective wall[12].

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11 These availabilities exceed the criterion of 99% of the worst month, equivalent in New York to 99.7% of the year, established for Direct Broadcasting Satellites (DBS).

12 The far field for the waveguide horns begins at 5-7 feet over the frequency range between 26.5 GHz to 40 GHz.

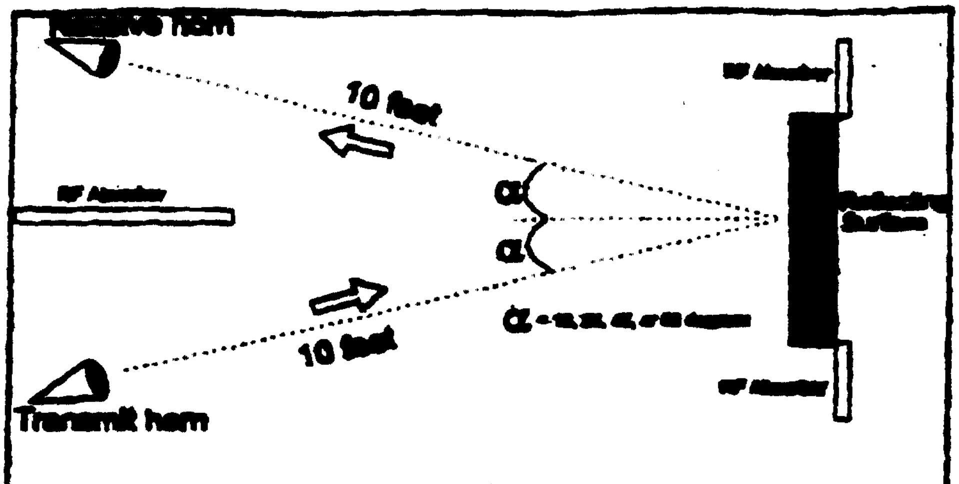

Figure 1 - Laboratory Test Configuration

For the first series of tests, measurements were made at 28.5 GHz and 39 GHz[13]. First, a 28.5 GHz signal was transmitted and the received power level was measured with the spectrum analyzer. Next, the signal generator was switched to 39.0 GHz and the received power level was again recorded while keeping all other parameters constant.

The second series of tests consisted of performing a swept amplitude response test over the entire 28.5 GHz to 40 GHz band. Measurements were made at the same angles of incidence and reflection and for the same reflective surfaces as used for the previous tests.

All of our measurements were made of reflected signals in the specular direction. As would be expected the metal and mirrored glass surfaces

13 Measurements were made at 39 GHz rather than 41.5 GHz in order to remain within the specified range of the calibrated standard horn.

reflected more signal energy than wood or concrete block[14]. These surfaces also provided greater uniformity in reflected signal strength when swept across the frequency range.

Our measurements indicate that, for smooth surfaces such as metal and mirrored glass, only slightly greater reflection of both wanted and interfering signals occurs at 28.5 GHz compared to 38 GHz (and by extension at 40.5-42.5 GHz). For rough surfaces such as concrete block, brick, wood and stone, commonly used in both suburban and metropolitan construction, the results show that neither 28.5 GHz nor 38 GHz demonstrated consistently better reflecting properties.

On the basis of these measurements, it is concluded that non-line-of-sight performance for an LMDS system operating at 40 GHz would be substantially the same as operation at 28 GHz[15].

Licensing rules

We note the proposal to designate the 40.5-42.5 GHz band for licensed use and to model licensing rules for this and other licensed bands after the rules and procedures proposed for LMDS. We think that these proposals are entirely fitting and to be the key to use of this band for LMDS in lieu of the 27.5-29.5 GHz band.

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14 The reflected signal levels from the block and wood surfaces were generally 10-16 dB below those from metal and mirror for both 28.5 GHz and 39 GHz.

15 The results of these tests call into question statements made regarding signal bounce in "LMDS is not Viable in the 40.5-42.5 GHz Band", an ex parte submission by The Suite 12 Group in CC Docket No. 92-297.

The Commission may want to evaluate whether use of Rand McNally Major Trading Areas (MTAs) as the service areas rather than Rand McNally Basic Trading Areas (BTAs) is appropriate in light of probable use of the band for LMDS.

LMDS rules have not yet been finalized and some changes may be desirable. If rules are modified for LMDS, these are the rules that should be applied to the 40.5-42.5 GHz band.

Technical standards

The technical standards proposed for licensed services are generally compatible with planned LMDS signal parameters as presented to the FCC Negotiated Rulemaking Committee. However, one parameter, e.i.r.p., requires attention. The proposed limit of 16 dBW, while adequate for the majority of LMDS links, is lower than the value that some LMDS proponents have said was needed for certain of their links[16]. One proponent submitted e.i.r.p. values ranging from 10 to 28 dBW in the absence of rain and from 28.7 to 38 dBW in rain. E.i.r.p. levels for a second proponent ranged from -7 dBW to 23 dBW in the absence of rain and from 5 to 35 dBW in rain. The third system considered by the Committee had e.i.r.p. values between -10 dBW and 10 dBW for all links, well within the limit proposed in the instant NPRM.

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16 "Report of the LMDS/FSS 28 GHz Band Negotiated Rulemaking Committee", Appendix 6, Table 2.3.1 - Signal Parameters WG1/52, September 23, 1994.